

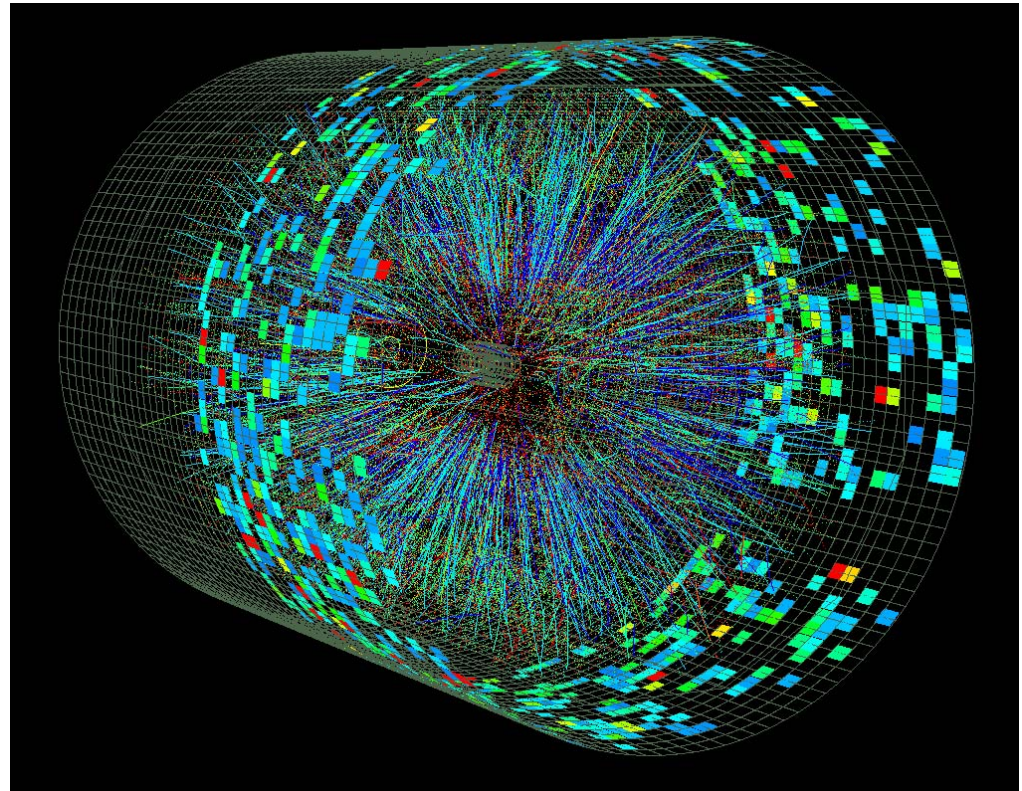
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RHIC Retreat 2005

June 15, 2005.

Outline

- How we did on reaching our Goals for the run
- Answers to Wolfram's questions
- Comments



STAR Beam Use Proposal for Run V (2004-2005)



Run V: Soft physics and High p_T comparison spectra; Charm and –Onium Yields;
Goal is > 50 M min-bias, ~ 10 nb $^{-1}$ sampled by HT trigger, $\sim 10\%$ at half field
Significant measurement of ΔG at $\sqrt{s} = 200$ GeV; Transverse spin studies
related to the Sivers Function

Table II: Run V Scenario

Beams	AA, A~ 60	$p \rightarrow p \rightarrow, p^\uparrow p^\uparrow$
Weeks	4 + 10	3+11
\sqrt{s}_{NN}	200*	200**

(* Depending on performance, 1-2 weeks at $\sqrt{s}_{NN} = 62.4$ GeV may be requested)

(** Goal is to sample > 7 pb $^{-1}$ with longitudinal polarization ($P > 40\%$); depending on performance, goal will then be to sample > 4 pb $^{-1}$ ($P > 40\%$); a second goal is to acquire > 20 M min bias pp events for comparison with $\sqrt{s}_{NN} = 200$ GeV AuAu dataset.)

Summary of the FY05 200 GeV CuCu Data Set



Total cuProductionMinBias Events: 51.6 Mevts

Total cuProductionHighTower Events: 23 Mevts

Min-bias Events (*Defined as zdc-cu-narrow triggers*):

- 64.47 Mevts (with Mag. Field) ~✓ Goal 80 Mevts
 - 43.47 Mevts with Reversed Full Field
 - 21.0 Mevts with Forward Full Field
- 487.2 kevt (with no Mag. Field)

HT18 Events:

✓ Goal 1 - 2 nb⁻¹. Achieved ~ 1.05 nb⁻¹

- 4.53 Mevts
 - 1.94 Mevts with Reversed Full Field
 - 2.59 Mevts with Forward Full Field

Cu-upc-emc Events:

- 161.535 kevt (all with Forward Full Field)

Cu-zero bias Events:

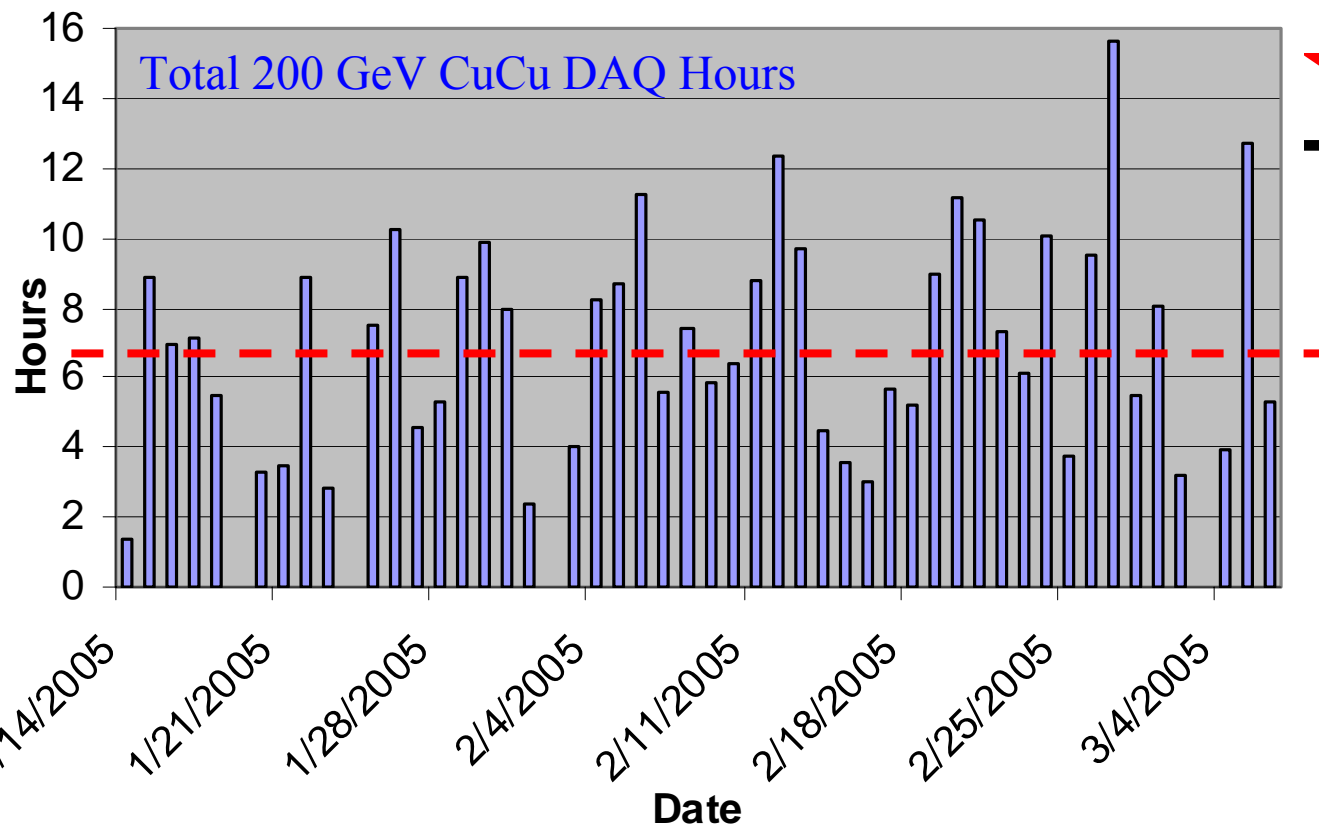
- 1079.273 kevt (with Mag. Field)
 - 504.336 kevt with Reversed Full Field
 - 574.937 kevt with Forward Full Field

FPD Events:

- cu-fpd: 268.294 kevt (all fpd trigger taken with FFF)
- cu-fpd-ht: 165.952 kevt

Upsilon Test Events: (all Upsilon Test evts taken with FFF)

- 4059 evts (with three different sets of selection parameters)



DAQ Hours

Total 1/14 to 8 pm 3/6 (52 days) = 336.87 hrs

$\langle \text{DAQ hrs/day} \rangle \sim 6.48 \text{ hrs/day}$

N.B. "DAQ hrs" only count time when production min-bias or High Tower Trigger Configurations are running.

DAQ Hrs for 8 am Tuesday Feb 22nd, to 8 am Tuesday Mar. 1st = 57.7 hrs.

DAQ Hrs for 8 am Tuesday Mar 1st, to 8 pm Sunday Mar. 6th = 31.6 hrs.

Rough estimate: $(1/.7) * 6.5 \text{ hrs/day} = 9.3 \text{ hrs/day}$ of beam availability. $9.3/24 = 39\%$

Final Event Totals for STAR Fy05 62.4 GeV CuCu Data Set

Total number of evts taken with Cu62productionMinBias Configuration = 37.781 Mevts

Total evts taken with cu62-bbc-narrow trigger = 27.262 Mevts

Total evts taken with cu62-zdc-narrow trigger = 26.805 Mevts

Total evts taken with cu62-zdc-tacs trigger = 1.678 Mevts

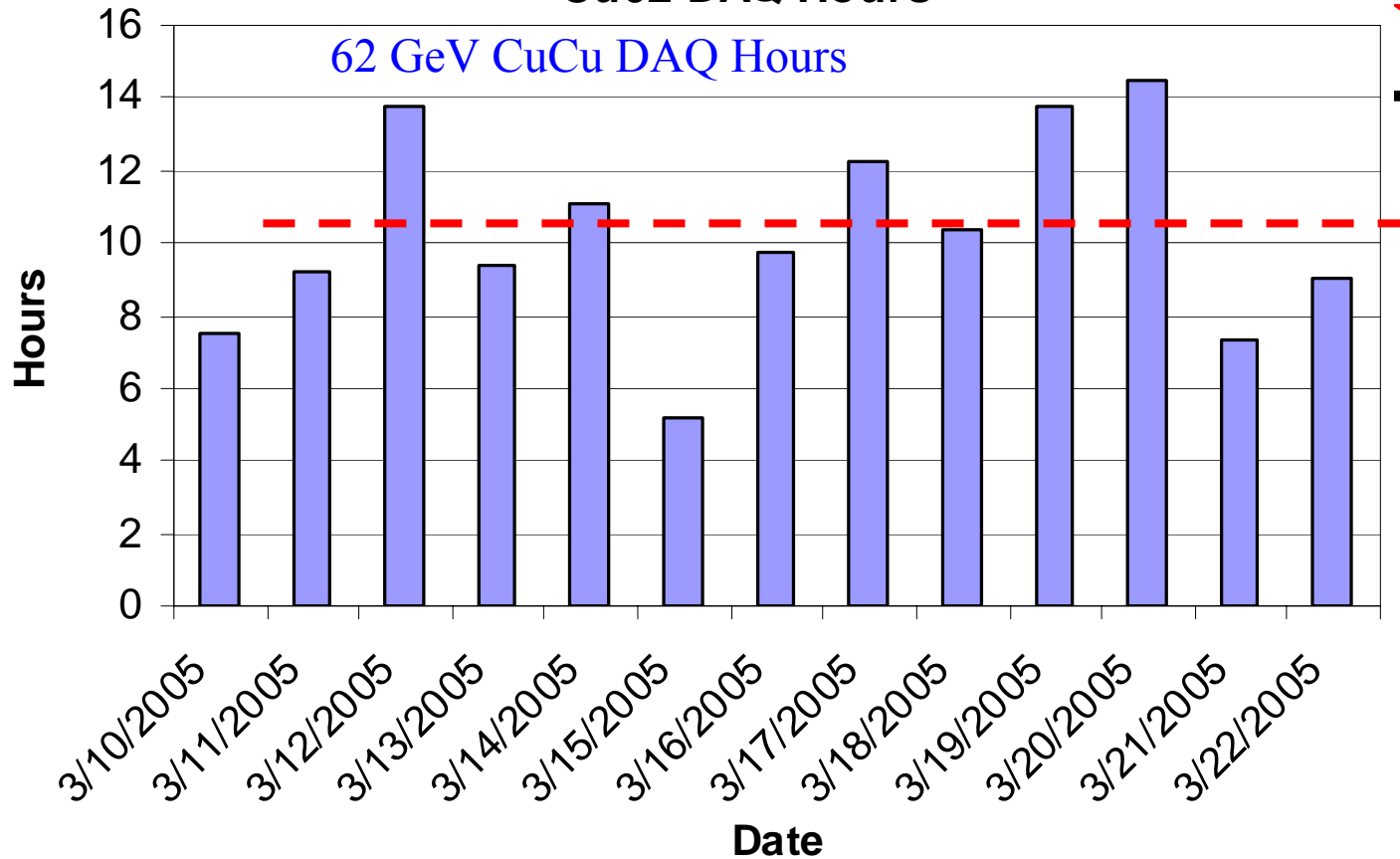
Total evts taken with cu62-zerobias trigger = 494.4 kevts

Total evts taken with cu62-zdc trigger = 113.8 kevts

Total evts taken with cu62-bbc-by trigger = 88.2 kevts

62.4 GeV Run was very successful, and we accumulated a significant data set!

Cu62 DAQ Hours



DAQ Hours

Total for 62 GeV CuCu run (3/10 through 3/22 (12.5 days)) = 133.01 hrs

<DAQ hrs/day> ~ 10.64 hrs/day

N.B. "DAQ hrs" only count time when production Cu62 Production Configuration is running.

Average evt rate ~ 79 Hz

*Rough estimate: $(1/.75) * 10.64 \text{ hrs/day} = 14.2 \text{ hrs/day of beam. } 14.2/24 \sim 60\%$*

Final Event Totals for 22 GeV CuCu Run (March 24, 2005)



Total number of evts taken with cu62ProductionMinBias Configuration = 4.106 Mevts

Total evts taken with cu22-bbc-narrow trigger = 3.427 Mevts

Total evts taken with cu22-zdc-tacs trigger = 995.2 kevts

Total evts taken with cu22-zdc trigger = 793.6 kevts

Total evts taken with cu22-zerobias trigger = 260.9 kevts

22 GeV Run went well, and should be an interesting data set once analyzed!

Total DAQ Hours for 22 GeV CuCu run = 17.57 hrs

Average evt rate ~ 65 Hz

Trigger data for run 6083020 ,
taken March 24th ~ 5 am

99913 evts in run.

$99913 - 5132 = 94,781$ evts of Physics

$13,510/94,781 = 14\%$ satisfy all triggers.

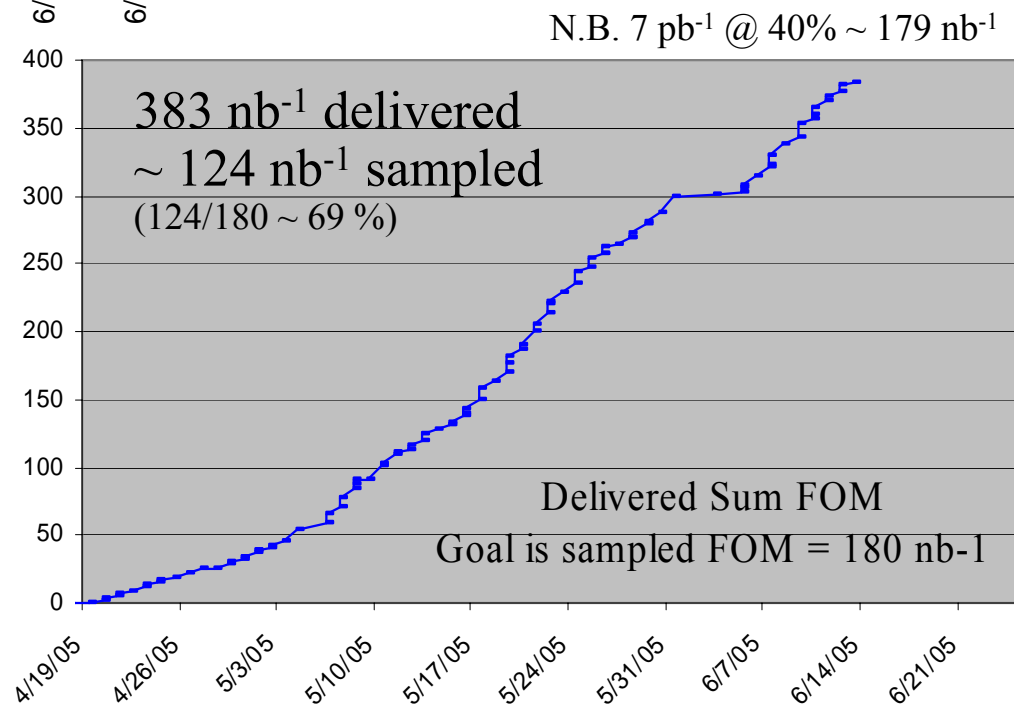
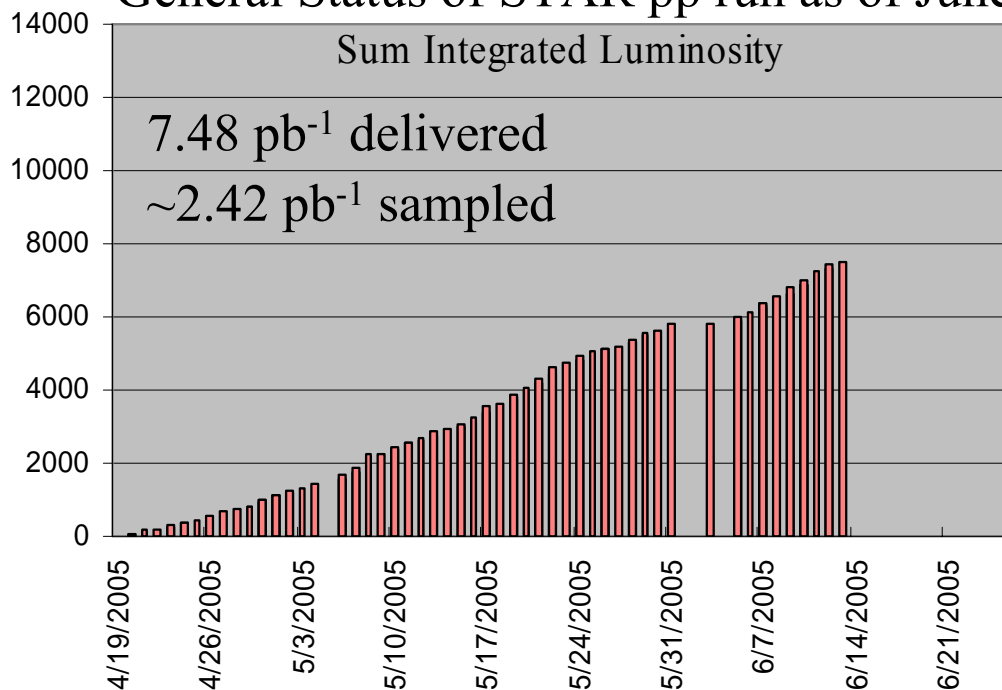
$63270/94781 = 67\%$ only BBC trig.

name	bit(daqTrgld)	offlineTrgld	prescale	numberOfEvents
cu22-zdc	1	86031	1.0	31510
cu22-zdc-tacs	10	86032	1.0	20975
cu22-bbc-narrow	10000	86011	1.0	83320
cu22-zerobias	100000	86300	1.0	5132

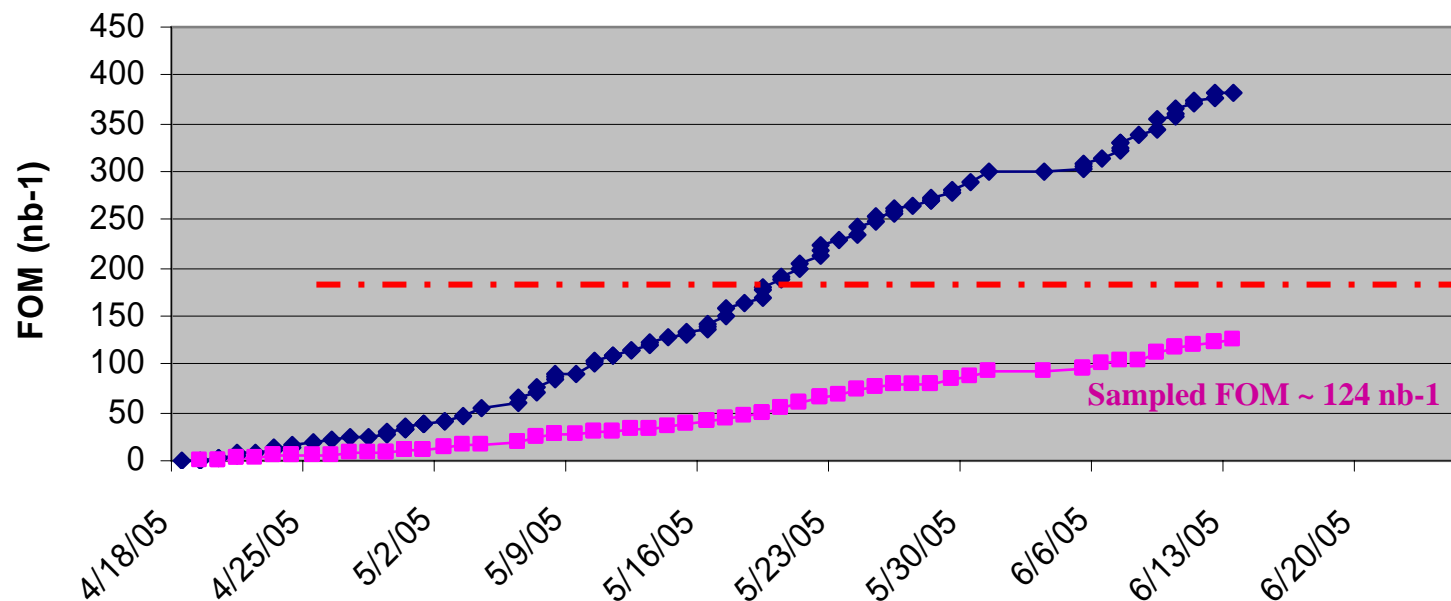
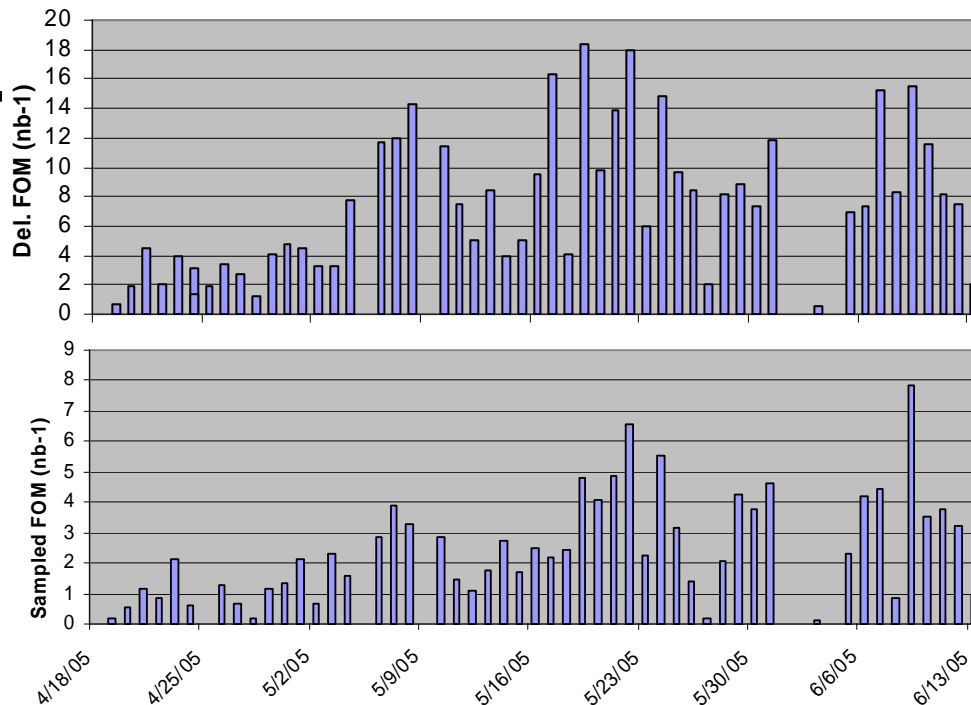
Trigger Mix (zero suppressed)

binary(summaryBits)	numberOfEvents
1	3996
11	7465
10000	63270
10001	6539
10011	13510
100000	5131
110000	1

General Status of STAR pp run as of June 13, 2005 (~noon).

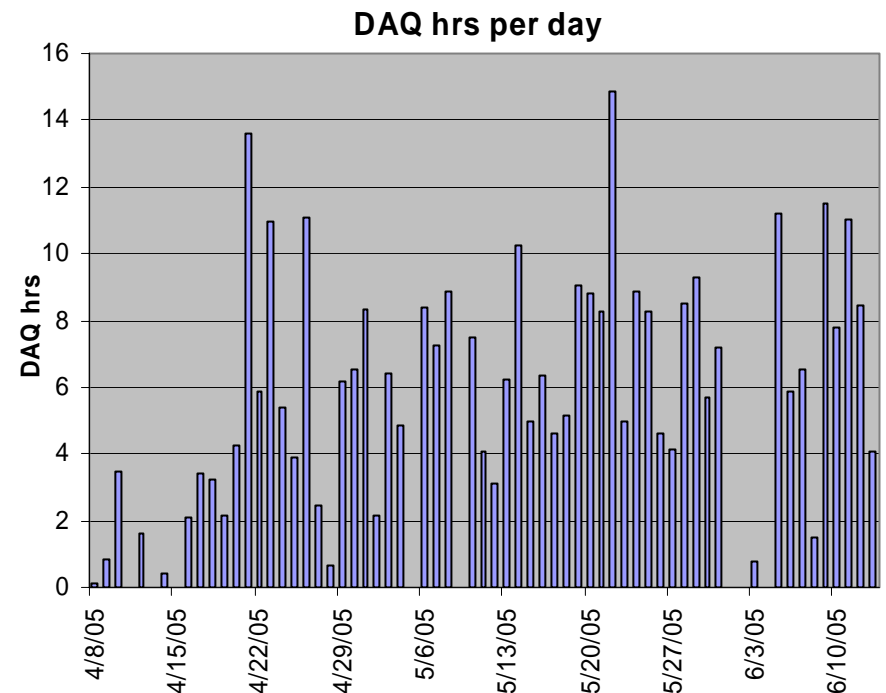
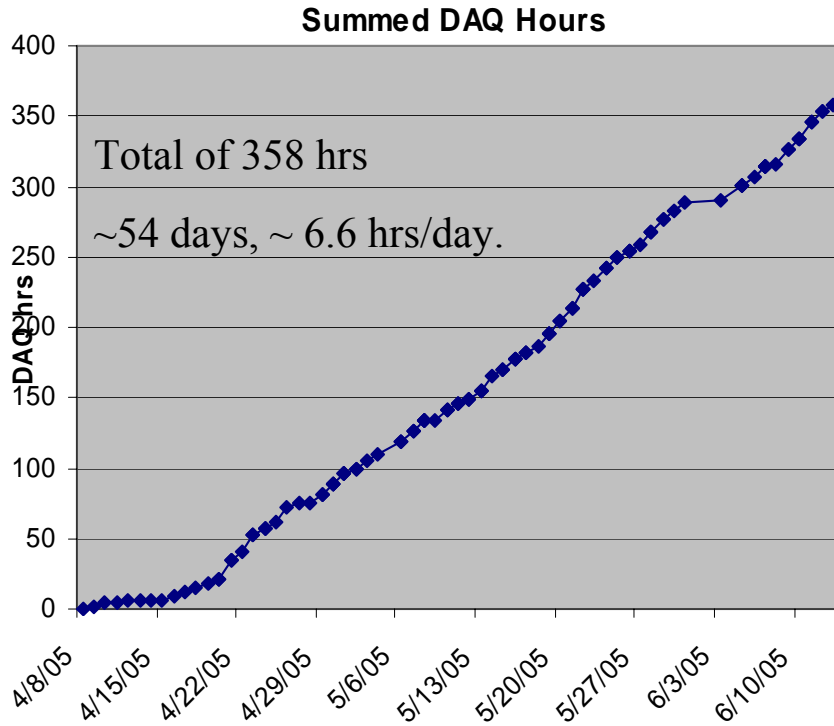
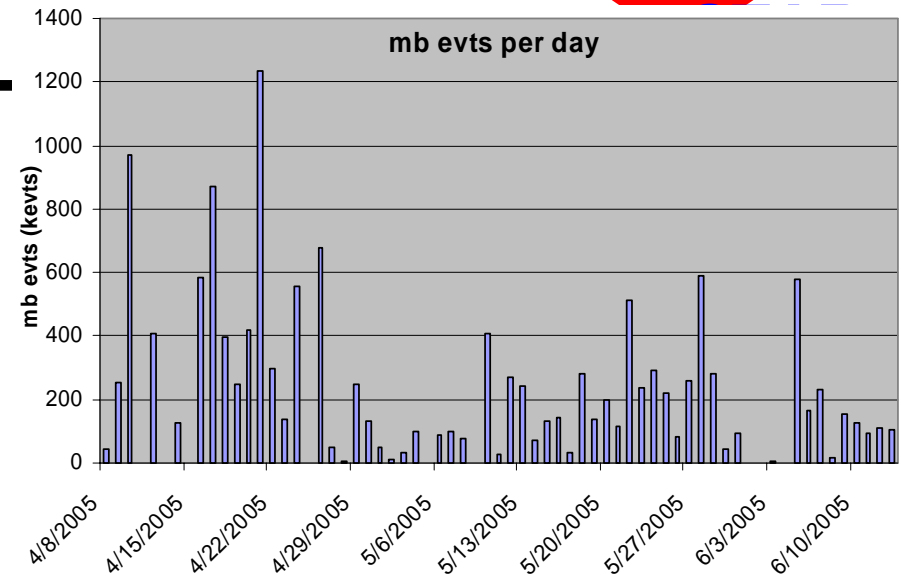
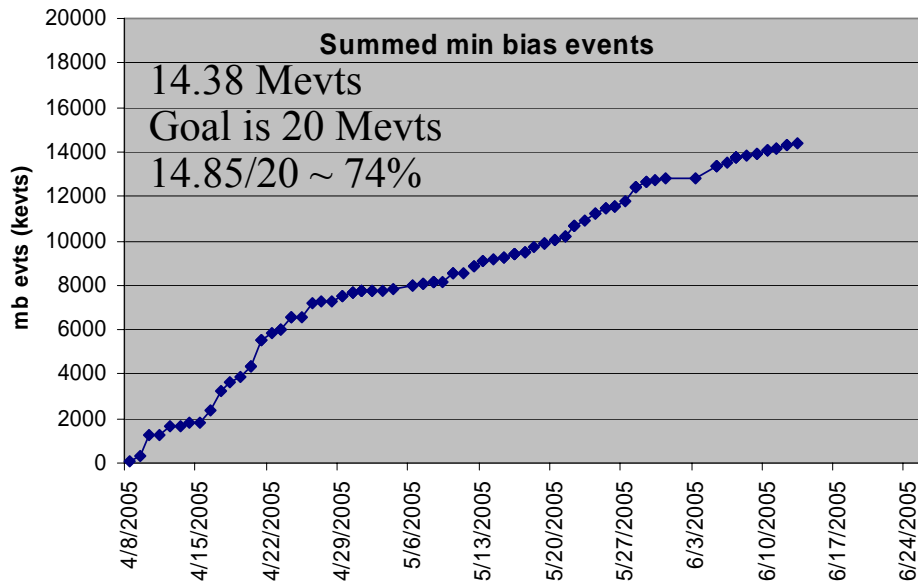


FOM plots through June 13, 2005 (~ noon).



Goal = 180 nb⁻¹
Sampled FOM
124/180 ~ 69%

General Status of STAR pp run as of June 13, 2005 (~noon).



Answers to Wolfram's Questions

1.) How can more delivered luminosity be turned into recorded luminosity?

a.) What are times when the detector is not running but luminosity is delivered?

- Many contributions account for this:

- Backgrounds too high for STAR to take data: It was not infrequently the case that STAR's background's were bad enough that we couldn't take physics data (either detector Safety or trigger corruption).
- ~ 3 times during the HI run, and ~ 3 times during the pp run, the backgrounds grew progressively worse over a course of days. In most instances, the backgrounds would be worked on by Collider Operators until they felt they'd done all they could, and then Shift crews would be told "There's nothing more that we can do". In at least two instances things just progressively worsened until I had to sit on Fulvia's or Mei's desk and tell them that we could no longer run at all, and to please fix the collider. We lose large fractions of a few days when this occurs. One shift was so bad that that TPC anode HVs tripped off on overcurrents ~ 25 times. Recovering from an anode trip takes about 5 minutes, during which we're not taking physics data.
- At the start of every store, prior to taking physics data, we take "Pedestal" files for most of the detector sub systems. These pedestals are taken under different conditions (e.g. Voltages) for various systems, and then the Sub systems have to be brought to operating voltages. Best case, this process takes about 10 to 15 minutes.

Answers to Wolfram's Questions (2)

- As part of our calibration procedure for the TPC, we typically take Laser events in the TPC. This entails stopping the collection of Physics data, warming up the Lasers, and then accumulating 2000 evts at 10 Hz. The process takes about 10 minutes. We typically try and either take some calorimeter based physics or calibration data while the Lasers warm up. During pp running, we take Laser calibrations during the polarization measurements.
- Problems with some sub system of the detector typically occur during the process of bringing the detector up for a store. When possible, we try and have alternative Trigger Configurations (combinations of Trigger components) available for the Shift crew to run while the problems are being diagnosed and resolved. Long down times seem to exacerbate these problems.

What of these times can be reduced or eliminated by an improved machine?

- The only obvious portion of this time that could be reduced is that spent with poor beam conditions after the Physics running has started. We should work to agree on acceptable background conditions as early as possible in a given running scenario. When this condition can't be achieved, the collider is "broken" and the necessary people (Accelerator Physicists or whomever else) should be called in to fix the problem. Telling the Experimental Shift Leaders that "There's nothing more we can do" (read "You can't get there from here") should only happen in exceptional circumstances.

Answers to Wolfram's Questions (3)

What are the times that detector operation is deemed too dangerous due to machine conditions?

- Injection, ramping, steering & collimation, dumping.

With five years of operational experience, can some of these times be re-declared?

- No. The benefits (small time savings, ~ 10 minutes/store) aren't worth the risks.

2.) Dealing with more luminosity and polarization.

- Can the experiments handle the enhanced luminosities ($2\times$ for ions, $60 \times 10^{30} \text{ cm}^{-2} \text{ s}^{-1}$ for pp at 100 GeV) ?
- Are new background problems anticipated at the higher luminosities?
- Do we need shielding, changes in collimation? Yes.
- Factor of two for ions, assuming that backgrounds can be kept in check or hopefully reduced, shouldn't create much trouble. Issues are "space charge" build up in the TPC and anodes tripping on high currents. We've developed realtime methods to correct for most space charge distortions. Careful collider control, and perhaps shielding, should be able to negate most of the problems with tripping off anodes.
- In addition to space charge and anode tripping, $60 \times 10^{30} \text{ cm}^{-2} \text{ s}^{-1}$ for pp will give interaction rates of $\sim 1.6 \text{ Mhz}$. This leads to "pile-up" in the TPC such that fragments of ~ 130 pp collisions will be in each TPC "event". We have ways to deal with this, but it will take effort. If current backgrounds remain, the corruption of our Physics triggers will become a serious problem.

Answers to Wolfram's Questions (4)

3.) Maintenance, Beam experiments, and access.

- Can we go from a 2-week to a 3-week maintenance cycle?

No. With the present policy we only use the 8 hr Shifts of scheduled maintenance if deemed necessary. If an 8 hour scheduled access could actually be held to 8 hours, the impact is $\sim 8/336 \sim 2.3\%$ of the time! **The problem here is not due to the experiments.**

-Is it possible to reduce the number of unscheduled accesses? Should we accumulate more requests for access before granting them?

We continually work to identify systems that aren't robust, and improve them, to avoid circumstances that require access to resolve.

I personally filter $\sim 90+\%$ of the STAR access requests. I generally don't request accesses unless the problem awaiting resolution seriously impacts the physics program we are trying to achieve. This process, where I determine when we can't wait longer than the next break between stores works well, and I don't see any other way that this can be handled.

-Can we have Beam Experiments on Tuesday, maintenance on Wednesday?

A theme in these questions, and in everything we do on the experiments, is to maximize our efficiency. The overlap day of Shift crews on Tuesday is very important in this respect. A thought may be to have Beam Exp. On Wednesday evenings and accesses on Thursdays (must be held to ~ 8 hours).

Answers to Wolfram's Questions (5)

4.) Communication.

- Do we need the scheduling meeting on Monday afternoon? If so, can it be attached to the 8:30 am RHIC meeting, say on Friday?

Yes, we need the Monday afternoon scheduling meeting. No, it shouldn't be attached to an 8:30 RHIC meeting, and certainly not on a Friday. Weekends are when we generally take the bulk of our data. By Monday afternoon both the Experiments and the Collider Run Coordinators have time to understand how the weekend went. It is also closer to the Scheduled access, on weeks where this occurs, and the closer one is the better the information on the need, or lack thereof, for the access. **The schedule that comes out of this meeting has to mean something!**

-Do we need to expand or change BERT?

I don't have any particular ideas on changes or enhancements needed for BERT. It has proved to be a very useful tool. One possible idea would be to include a "Count Down" clock if we ever decide to try more rigidly timed Beam dumps.

-Any other way that we should change communication between experiments and scheduling physicist, RHIC Run Coordinator, and the MCR?

Not so much change, as go back to last year's practices. Once the Schedule is agreed to on Monday, only the Scheduling Physicist should be allowed to change it. If it changes, the Scheduling Physicist has to contact all parties and inform them of the change.

5.) Store length.

- Fixed or variable store length preferred?
- Fixed length with option of extension?

I guess I'd state the actual, and I think optimum, policy as:

“Nominal fill length with option to modify particular store's length via consensus on the part of STAR and PHENIX”.

This is, I believe, how we've actually been running. The nominal store length is fixed to be, for example 7 hours. If, for a particular store, both STAR and PHENIX agree the store should be dumped earlier or later, then with proper consideration given to injector preparation, that is what should happen. I think this policy has worked well, and should be continued.

General Comments on the FY05 Run



- Although the purpose of these Retreats is to look at, and perhaps suggest criticisms of, how various aspects of the overall RHIC Operations went, one shouldn't lose sight of the fact that we accumulated high statistics data sets which should lead to interesting and significant physics insights. It is another in a string of successful runs.
- With the exception of an isolated week here or there, for me, with the various hats I wear related to the operation of the STAR Detector and the task of accumulating the data sets which the Collaboration desires, this run has been a constant struggle. I think a significant reason for this has been the continuing, and continually dynamic, problems that STAR has had with backgrounds.
- STAR would like to start working with the relevant people from C-AD on the design and implementation of shielding between the collider tunnels and the STAR IR. We've taken a number of different triggered data sets in the hope of understanding some of the characteristics of the backgrounds we've experienced this year. I think that once all is said and done, the best plan is likely to just be to fill the tunnel regions on both sides of STAR, similar to what was decided and implemented for PHENIX.



General Comments on the FY05 Run(2)

- I believe that one of the most significant outcomes of a few of the previous RHIC Retreats was the setting up of the Monday weekly Scheduling meeting, with the understanding that all parties, the Experiments, the Beam Experiment Coordinator, and the Collider Coordinators had to come prepared to discuss what they needed and agree on a schedule for the week. Once this schedule was set at this meeting it was only to be changed with the consent of the Scheduling Physicist, after whatever level of consultation with the parties he/she deemed appropriate. Finally, it was the responsibility of the Scheduling Physicist to inform all parties of any modification of the plan.
- This policy/practice led to the ability to make multi-day plans, arrange with necessary experts to plan the myriad of things that have to be done by all parties, leads to increased efficiencies in all aspects of Operations, and removed the daily/hourly burden of having to try and discern via contacting various people what the “current” plan/schedule is.
- This extremely important process failed for the entire FY05 run, and I feel strongly that it must be reinstituted for all future runs.



General Comments on the FY05 Run(3)

- On the question of efficiencies, this is rightly identified as something we all have to be concerned with, and continually work to improve.
- The improvement that STAR can make which will lead to the largest increase it can achieve in the fraction of the delivered luminosity which is sampled is the implementation of the *DAQ1000* TPC electronics upgrade. For the way we typically run STAR (i.e. with 50% deadtime) this will increase our sampled luminosity by a factor of two. The deadtime becomes essentially zero.
- We constantly look at how we train and instruct our Collaborators to run STAR. I try to tell each week's Shift Leaders to think about how they are spending their time, and either bring up at our daily operations meetings, or tell me personally, any ideas/suggestions they have on how things could be done better or more efficiently. We have our own yearly "Critique" meetings, analogous to this Retreat meeting, where we discuss all aspects of the run and how we can improve.
- Depending on what system we're running, as well as how smoothly the collider is running, I estimate that we generally average in the range of 65 to 75% efficiency (taking Physics or necessary calibration data when usable beam in the Collider). We'll never stop working on this, but I think the most one can hope for is an increase of the order of 5 to 10%. I take as some evidence of this just how close the total DAQ hours were this year for STAR and PHENIX.

Having the Retreat before the end of the Run is a bad idea.